

TEMPORAL FACTORS IN AVOIDANCE LEARNING¹

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Solomon and Brush (1956) in their review of avoidance learning distinguish between temporal and nontemporal parameters in the study of conditioned avoidance learning. Although the number of temporal parameters that have been investigated is extensive, there is little mention of the temporal characteristics of the intertrial interval (ITI), i.e., the interval between the presentations of the CS, as a factor in the acquisition of an avoidance response.

The purpose of the present study was to investigate the effects of two temporal characteristics of the ITI on avoidance learning. These characteristics were (a) the duration of the ITI and (b) whether the ITI was of a fixed or a variable duration.

Murphy and Miller (1956) studied the effects of different durations of the ITI on the acquisition and extinction of a conditioned avoidance response. They found that a 40-sec. ITI resulted in significantly more rapid acquisition than did a 20-sec. ITI. However, the 40-sec. group did not differ from a group which was trained under a progressively diminished interval procedure, ITIs starting at 60 sec. during conditioning and diminishing to 20 sec. The use of this progressively diminishing interval procedure does not, however, permit the evaluation of the effects of longer ITIs.

Research by Sidman (1956) indicates that temporal cues are important in avoidance learning. Sidman found that the addition of a discriminable warning signal facilitated the development of a temporal discrimination. The present study investigated whether the existence of temporal cues facilitated the acquisition of a discrimination avoidance learning.

METHOD

Subjects

The Ss were 36 experimentally naive, Long-Evans male hooded rats purchased from the Rockland Farms. These Ss were between 90 and 100 days at the start of the experiment.

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Apparatus

The apparatus was a Miller-Mowrer shuttle box, 9 in. by 18 in. by 12 in. high, separated into two compartments by a partition with a 4 in. by 5 in. opening at the center bottom, constituting a passageway between compartments. The US was electric shock, administered through a grid floor. The grids were scrambled with a Grason-Stadler mechanical grid scrambler. The shock source was a matched impedance 60-cycle ac source (after Campbell & Teghtsoonian, 1958). It consists of a variable transformer driving a stepup transformer, with a 130 kilohms resistor in series with the rat. For this experiment the shock source was adjusted to deliver 700 μ a., RMS, into a dummy load. The S may receive a *constant-power* shock of no more than this maximum. The CS was a small buzzer of a *fundamental frequency* of about 120 cycles per second.

Procedure

Prior to the conditioning trials on each day the Ss were given a 1-min. adaptation period. At the end of this period the onset of the CS marked the beginning of that day's session. The CS was presented for 3 sec. at which time the shock was presented automatically if the S failed to cross during the 3 sec. of CS presentation. The CS and UCS remained on until the S crossed, at which time both CS and UCS were terminated automatically. Upon termination of either the buzzer, or the buzzer and shock, a punched-tape intertrial timer began operation which determined the interval to the onset of the next CS. The 36 Ss were randomly assigned to one of four experimental treatments in a 2×2 factorial design. There were nine Ss per treatment. In Group SF (Spaced Fixed) the Ss were trained with a fixed 60-sec. interval between CS presentations; in Group SV (Spaced Variable) the ITI averaged 60 sec. but each time interval varied from the mean randomly. The range of the time intervals used was from 40 to 80 sec. In Group MF (Massed Fixed) a constant 20-sec. ITI was used, and in Group MV (Massed Variable) each time interval varied randomly from a mean of 20 sec., the deviation being from 10 to 30 sec.

Each S was given 30 trials per day, for five days. All Ss were maintained on ad lib food and water.

RESULTS AND DISCUSSION

The percentages of correct (avoidance) responses for each day's sessions are presented in Figure 1. Table 1 summarizes the analysis of variance for the total number of avoidance responses.

A square-root transformation was used in order to meet the assumption of homogeneity of variance. This analysis revealed both main

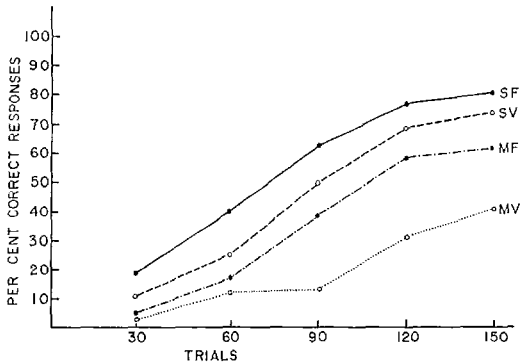


FIG. 1. Percentages of avoidance responses per session during acquisition.

effects to be statistically significant. Thus, *Ss* trained under the massed condition performed at a significantly lower level than the spaced trained *Ss*, and the fixed-interval *Ss* made significantly more avoidance responses than the variable trained *Ss*. The interaction did not approach significance.

The more rapid acquisition of an avoidance response by the *Ss* run with 60-sec. ITIs confirms the observations of Murphy and Miller. In addition, Brush (1959) showed that still longer ITIs resulted in more rapid acquisition with a 5-min. ITI being the maximum. Inter-

vals of 10 min. in the Brush study yielded an acquisition rate less rapid than that obtained using shorter time intervals.

The results of the present study further indicate that temporal cues facilitate the acquisition of a discrimination avoidance response and thus further emphasize the importance of temporal cues in avoidance learning.

SUMMARY

The effects of long versus short intertrial intervals and fixed versus variable intertrial intervals on the acquisition of a conditioned avoidance response were investigated.

The results indicated that a 60-sec. intertrial interval resulted in more rapid acquisition than a 20-sec. intertrial interval, and that the fixed-interval condition resulted in more rapid acquisition than the variable interval.

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TABLE 1

SUMMARY OF ANALYSIS OF VARIANCE

Source	df	MS	F	p
Between Spaced and Massed	1	56.87	17.88	< .001
Between Fixed and Variable	1	16.44	5.17	< .05
Interaction	1	2.78	—	NS
Within	32	3.18		
Total	35			